

MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

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[NUMBER 2.]

"It is freedom of communication that prevents evil; let men communicate their sentiments to one another, it is like fire scattered on the ground, or like gunpowder scattered on the surface of the earth: it communicates, but the explosion is not heard; keep it under constraint, it is like gunpowder compressed, and like subterraneous fire, whose agitation is unseen until it bursts into an earthquake. Let argument be opposed by argument, and reason opposed to reason."—**ERSKINE.**

Animal Mechanics, or Proofs of Design in the Animal Frame. Part II., showing the Application of the Living Forces. [From the Library of Useful Knowledge.]

(Continued from page 44.)

With these facts before us, we turn with interest to what the anatomist too often contemplates with unconcern: we mean the different curves in the branching of the arteries and veins; for by this law of hydraulics the junction of the branches and trunks of the arteries and veins ought to be different, as the one vessel, the artery, carries the blood out from the heart, that is, from trunk to branch; and the other vessel, the vein, carries it in the opposite direction towards the heart, or from branch to trunk.

And, in matter of fact, their branchings are very different, and characteristic of the vessels. We have heard a teacher of anatomy express himself in this manner: "The arteries are active and powerful vessels, which carry the arterial blood out from the heart; and they receive the forcible impetus of the heart. When they are wounded, the man bleeds to death; therefore, nature conveys these vessels into the recesses of the body, taking advantage of every protecting bone—conveying them so that the bones and the muscles protect them. There are no irregularities in their course, and their branches go off at a determined angle, and never irregular; but the veins," he would continue, "are vessels of less importance: they convey the blood back to the heart, with a languid motion, and if they are wounded the blood flows with so diminished a force that you can stop it with the pressure of your finger; accordingly, nature is more negligent of them: they run in all their courses irregularly—some deep, some superficially; and their branches join their trunks with awkward irregular curves and elbows."

This is in good feeling and is in part true; but it contains somewhat of the error which runs through most anatomical discourses, of

supposing things are irregular, as if the objects in view were inartificially and imperfectly attained. From inattention to the hydraulic principle, he seems not to have considered that the connection of trunk and branch must vary according to the direction of the stream—that the direction of the branch, which is adapted to lead the stream from the trunk into the branch, must be altered when the design is to convey the fluid from the branch into the trunk.

The reader will now understand, that the branch of the artery (fig. 18, No. 1,) gently diverges from the direction of the stream,

Fig. 18.



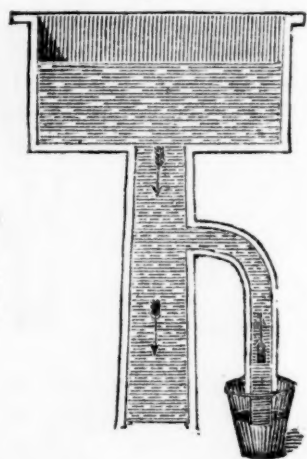
while the branch of the vein, in No. 2, enters abruptly and at right angles. We may illustrate this, by observing, that if we could suppose the vein substituted for the artery, and the artery for the vein—if the vein carried the blood outwards, instead of towards the heart, and the artery conveyed the blood back to the heart,—the blood could not run in the circle; it would be retarded, and congestion would take place, somewhere in its course.

We have seen by the demonstration above, that if the veins of the human body were rigid tubes, and if a hole were made in their sides, air might be drawn in instead of the

blood flowing out. This is a matter of vital consequence, for if a very little air be blown into the veins of an animal it dies in an instant, and there is no suffering, nor struggle, nor any stage of transition, so immediately does the stillness of death take possession of every part of the frame.

In conversation with Napoleon's celebrated surgeon, Baron Larrey, on the case of a young man wounded in the neck, he said he had no hesitation in declaring the cause of death to be air drawn in by the veins of the neck, and he quoted instances occurring at the battle of Wagram. These circumstances greatly increase the interest of an experiment made by Dr. Barry, who found that on introducing a tube into the vein of the neck, and placing the other end of the tube in a vessel of water, the water rose during inspiration. The difficulty of explaining this arises from those veins being membranous tubes, and consequently compressible; but in the act of inspiration, not only are the ribs and breast bone raised, but the muscles of the neck attached to the collar bone rise from the veins of the neck. By this means, instead of suffering the compression of the incumbent parts, the atmospheric pressure is taken off the veins; they are brought to the condition of rigid tubes; and the principles of hydraulics explain the rest. Thus, fig. 19 is a reservoir emptied by a perpendicu-

Fig. 19.

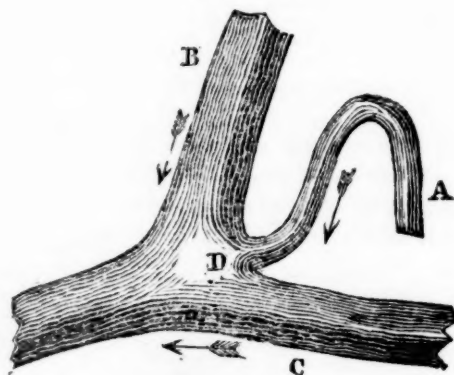


lar tube, into which a smaller tube is inserted. The water descending by the larger tube will draw the water up through the lesser tube, so as to empty the glass, in which its lower end is immersed.

We shall here give an example of the manner in which the trunk of the absorbent system joins the venous system, a circumstance which has not escaped the notice of anatomists. The absorbing or lymphatic system consists of a set of vessels different from arteries and veins, which imbibe by a

sort of capillary attraction at their extremities, and convey their fluids towards the centre, without any such impulse as the proper blood vessels receive from the heart. The stream in the trunk of this vessel has no force to impel it into the stream of blood in the veins; it enters, therefore, in this manner.

Fig. 20.



A is the trunk of this system, called the thoracic duct; B is the great jugular vein descending from the head; and C, the great vein coming from the arm. These veins join at an angle, and the streams from them, in the direction of the arrows, leave a point between them at D, where there is no pressure. If two tubes enter into a larger tube obliquely, and the water be flowing from the lesser tubes into the greater one, and if a hole be bored at the angle of their union, the water will not escape at that hole. Therefore, the fluid from the thoracic tube A meets with no impediment at the point D; when entered, we have seen, by a former diagram, how the attraction of the more forcible stream will draw the contiguous fluid after it. By this contrivance, if we may use the word, the fluid in the absorbing system finds access to the red blood, and is carried into the heart. We might continue this subject by considering the influence of respiration on the circulation; but we shall pursue the inquiry into the hydraulic principles, as applicable to the circulation, independently of pneumatics.

The law of inertia, which is of easy comprehension as it regards solids, is also applicable to fluids; it is easier to keep a column of water in a pipe in motion than to put it into motion from a state of rest.

In a forcing pump, when after each movement of the piston the columns of water become stationary, power is unnecessarily lost by bringing the column of water, which is in this state of rest, again into motion; but if a second blow of the engine be given to the column of water whilst it is yet moving,

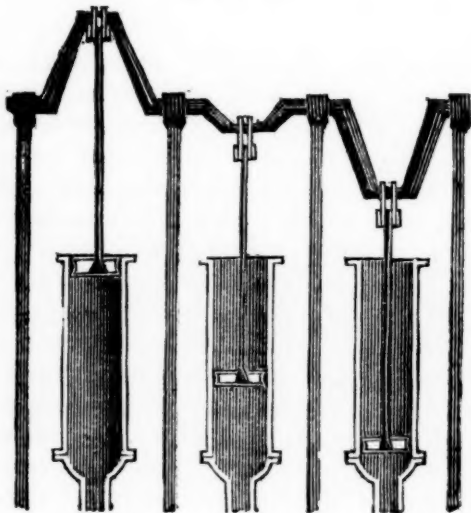
it is found to be more easily pressed forward, and no part of the force is lost in urging it from a state of rest into motion. This is evinced in the contrivances of the engineer. He employs two forcing pumps instead of one, and he so applies his lever as to operate alternately on the one and the other; to the end that the water in the pipe may be kept in uninterrupted motion. Let us apply this principle to the circulation of the blood.

If the heart were the only power forcing on the blood, there would be a cessation of motion after each pulse of the heart, and therefore a great part of its power would be lost. This explains why there is a power in the artery as well as in the heart. The artery being muscular seconds the operations of the heart; its muscularity, and the muscularity of the heart, are powers exercised alternately, and which, acting like the double stroke of the engine, permit no interval to the motion of the column of blood. If the heart had to act upon a column of blood at rest, not only much of its force would be unnecessarily exhausted, but it would be excited to propel an inert body, and a dangerous shock would arise from the resistance.

If we pursue this subject, and inquire what is essential to such a hydraulic machine as we are contemplating, we shall perceive that the engineer meets with a difficulty in adjusting the powers of his two pumps, and finds an interval, or pause, in the application of their forces.

To obviate this, he makes three cylinders, the pistons of which are moved by a crank,

Fig. 21.



which so orders the descent of the pistons as to fill up this interval, so that one of the pistons shall be always descending; and these pumps propelling the water into a common

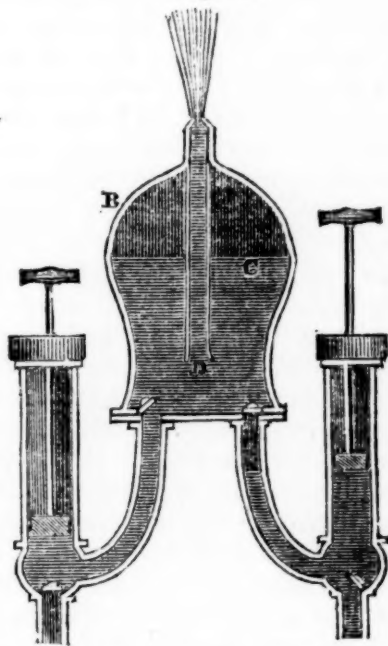
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tube, there is no interval to the motion of the fluid through it.

By this example we are led to look for something corresponding in the machinery of the circulation. We find no third active power, however; yet we find a quality in the blood vessels which answers the purpose much better. But to comprehend this, we must observe that the engineer has a more admirable contrivance than this of a third pump to adjust the action of the other two.

He confines a body of air, which, by its elasticity, performs the office. The pipes

Fig. 22.



of two forcing pumps are carried into the reservoir, B; they convey the water up to C, by which time the air is compressed, and its elasticity thereby increased. That elasticity is exerted without interval, and, acting on the water, C, propels it into the tube, D, uninterruptedly.

Just such an elastic property is possessed by the arteries. The great artery which goes out from the heart, as we have had repeated occasion to observe, makes a sweeping curve; it is capacious, and is the most perfectly elastic of any thing in nature. Here then we have the three powers which the engineer finds necessary to employ. We have the alternate action of the heart and the artery, and we have an elasticity, which, though passive, is essential, both to the uniform flow of the blood, by filling up the interval in the action of the two powers, and to the safety of the engine itself; for without this elasticity, there would be such a jar as must speedily destroy the mechanism.*

* But does the blood flow uniformly? Not precisely so in the arteries, since the stroke of the heart is more powerful,

There is nothing more admirable than the influence of this elastic power; it is greatest in the coats of the artery near the heart, weaker in the coats of that artery as it recedes from the heart: this very evidently declares its use, but we shall take a more sufficient proof, although an unhappy one.

As life advances, the arterial system loses much of its elasticity, and becomes rigid. This is so common an occurrence that we can no more call it a disease than the stiffened joints of an old man: it is the forerunner or the accompaniment of the decline of life. But this sometimes takes place too early in life, and to an extreme degree; and from its effects we must call it morbid, for it not unfrequently happens that the muscular power of the heart being still entire and vigorous, the arteries can no longer sustain it. They are not now endowed with that power which, yielding to the heart's action, resists, and recoils the more it yields,—which takes off all sudden shock, and which in yielding wastes no power, since on its recoil it gives as much force to the acceleration of the blood as was lost of the heart's action. The artery then, becoming rigid, yields indeed to the heart's impulse, but has no recoil. It is permanently dilated or enlarged. It is now called aneurismal. A stronger impulse from the heart, excited by inordinate action or passion, chips and bursts the now rigid coats of the artery. If the breach be sudden, it is death; if it be gradual, a pouch forms—a true aneurism. And now we have the proof we require: for this bag coming to press upon the solid bones, they are destroyed. That action of the heart which was so lightly and so easily borne whilst the vessels were elastic, now beating upon a solid structure, in a short time destroys it. Thus we are led to a more accurate knowledge of the fine adjustment of the active and resisting properties in the circulating vessels during youth and health, by what takes place on a very slight derangement of those powers.

Sailing against the Wind.

To the Editor of the Mechanics' Magazine:

SIR,—I beg leave to offer a few remarks on the quotation in the last number of the Mechanics' Magazine from a London paper, respecting sailing against the wind.

There is no axiom, perhaps, in the science of mechanics, better established than that ac-

or rather more concentrated, than that of the arteries. During the contraction of the ventricle of the heart, the artery is dilated, but it is never emptied; and the flow of the blood forwards in the course of the circulation is not for an instant interrupted.

tion and re-action are equal. Now, "let a ship be provided with sails like those of a windmill, and let the power thus acquired work a paddle wheel"—let the wheel operate in a contrary direction from that of the wind and sails; then the power of the wind against the sails would be exactly equal to that of the paddles against the water, *minus* the friction.

Suppose the resistance from friction to be equal to one fourth of the power; and suppose the wind to act on the sails with a power which would carry the ship from north to south 8 miles an hour; then the power of the paddles to carry the ship north would be $8 - 2 = 6$ miles an hour; so that while she went 6 miles to the south, she would go 8 miles to the north—that is, two miles per hour *astern*. This would be a useful invention indeed!! much like some other improvements of modern date.

SIMPLEX.

Twin-Boats—Archimedes in reply to Mr. Chas. Harris.

To the Editor of the Mechanics' Magazine:

SIR,—I hope you will not deny me the privilege of using the Magazine to express to Mr. Charles Harris assurances of my gratitude as well as extreme gratification, for his having condescended to notice so unworthy an individual, especially for having thus publicly acknowledged that he believed, or at least that he once believed, that I was *honest* and *generous*, though rather simple. But all this is nothing to the pride I feel in having afforded (by my simplicities no doubt) amusement—yes, real amusement, to a man distinguished by so much ingenuity and erudition.

But great characters sometimes make mistakes; and I must beg leave before the present inflation of my vanity subsides, to hint, with great deference, that even Mr. Harris himself has made some little mistakes in quoting my language. A passage in his second communication reads thus: "He says," (that is, I, Archimedes, says,) "that the average gain resulting from the swell was five miles per hour." Now, some miraculous optical delusions must have misled the sagacity of Mr. Harris, for there was not in my communication one word about *five miles* an hour, nor any average gain whatever, nor even the word *average*. I only stated that she gained from 4 to 6 miles per hour—that is, supplying the ellipsis, from 4 miles *per hour* to 6 miles *per hour*. From this H. calculated, with amazing precision, that "her improved speed must have been

exactly 55 miles per hour;" or, to show his great clemency, he condescended to get the boat out of difficulty by a more favorable calculation, allowing that from four to six meant only a gain of 30 per cent., and that she only went 15 miles per hour. But still not satisfied, like the man with the monkey's tail, he set the gain, (from 4 to 6,) at 100 per cent., and then, strange to tell, the boat only went 10 miles per hour.

In his last number, with the help of the boy in the counting room, and after conjuring up also the shade of Archimedes of Syracuse to help him, he has manufactured a whole family of per cents., all out of a gain from 4 to 6.

His arithmetic, then, stands thus: From 4 to 6, that is, the difference between 4 and 6, or the distance between the 4 mile stone and the 6 mile stone is, (in the first case,) just 55 miles.

In the second case, the same difference is equal to 50 per cent., equal to 15; in the third case, the same difference is equal to 100 per cent., equal to 10.

Had I been aware of the surprising talents of Mr. H., I certainly would not have exposed myself to the liability of any controversy with him. I certainly did not know that it was necessary to have a collision between Neptune and Æolus to admit a boat 35 feet long to run up the narrow river from New-London to Norwich. I only stated what persons of high respectability, now living at New-London, at least believe they saw.

To conclude, I most earnestly implore the pardon of Mr. H. for supposing that he could for a moment so far descend from the sublime technicality of naval architecture, to the vulgar vernacular tongue, as to admit that "finery" was a derivative of fine. And to prevent me from being exposed to vulgar eyes, completely overcome and subdued, as I consider myself, by the talents of Mr. H., I must beg of him, if he condescends to notice me again, to write in Latin and French, with a little intermixture perhaps of Greek and Hebrew, as, by the shade of my old namesake, he will probably be much better understood in the two last than in English, and I can get a minister to translate them for me with very little trouble.

ARCHIMEDES.

Twin-Passage Boat for Canals. [From the London Mechanics' Magazine.]

SIR,—It occurred to me when I was writing the concluding paragraph of my last letter to you, that twin passage-boats having the form shown in the annexed sketch, (which



is a top view,) would send no waves towards the banks, and might be used to advantage on canals that had no stone facing along the sides. The two outside surfaces of the boats are straight and parallel in the direction of their length, but may be curved like any other boat, from the top edge downwards, and the two interior sides must have the gishape as nearly as possible. The two cross-pieces connect the boats, and the tow-line is fixed to the part running up the centre. Any wave that is formed between the boats will settle at the stern, and act in the same way as the wave in the case of the Paisley canal passage-boats; and the parallel outside surfaces of the boats can raise no wave. I made a model five feet long, with the other dimensions in proportion, to try its effect, and when it was drawn through the water at the best velocity, the water all around was perfectly smooth, although there was a large wave formed between the boats. The wave commenced a little behind the bow, and it was level with the surface of the canal before it reached the stern; if the curved sides of the boats had been out, this wave would have been driven to the banks of the canal.

As twin boats are not likely to upset, they may be built very narrow, and not take up much room in the breadth of the canal, if their draft of water is increased. Part of the deck that holds the boats together, may be formed into seats, and all the passengers may sit with their feet down into the boats, and their faces towards the banks of the canal. The centre part of the deck may be used for walking upon, as the passengers, when standing on it, will be high enough to see over the awnings that cover the cabins. At places where the deck, for the sake of binding the boats more firmly together, must stretch from outside to outside, doors may be left from the deck to the cabins. As no waves leave a boat of this sort, it certainly must take less power to work it, on which account I think the principle may be applied to little sailing craft, such as pleasure boats. The waves that are formed by the paddle of a twin steamboat might be got quit of by forming the stern properly. In my model, the outsides were plain and parallel in the up and down, as well as in the length direction. I am, sir, yours truly,

JAMES WHITELAW

Glasgow, April 18, 1834.

Improved Method of Sheathing the Bottoms of Vessels.

To the Editor of the *Mechanics' Magazine* :

SIR,—Having in a late communication described an apparatus for raising vessels for the purpose of repair, I shall now propose an improved method of sheathing the bottoms of vessels, as follows: Long plates of copper, or other metal, are cut to a breadth and shape nearly corresponding with those of the planks over which the sheathing is to be laid; and these plates are so placed on the planks that the edges of each plate shall lie between the seams of the planks. Each plate is first tacked to the bottom with small tacks or nails, merely sufficient to sustain it, till two or more plates are placed side by side, the edges of each two plates being nearly one fourth of an inch apart; then a flat rod of copper or brass, about five eighths of an inch wide, and one eighth of an inch thick, having counter-sunk screw holes through it at every two or three inches of its length, is placed over the seam formed by the edges of each two plates, and is fastened with wood screws, or nails with heads similar to those of wood screws, that when driven the heads may be even with the surface of the metallic rod. The plates and rods should be as long as the vessel to which they are applied; but when this is not practicable, the ends of each piece must be chamfered so that the end of one piece may extend a little over that of another, without occasioning any projection or unevenness in the surface. The principal object of the improvement is to facilitate the speed of vessels, particularly steamboats. For this purpose, plates of an alloy, composed of tin and lead, equal quantities, are decidedly preferable to those of copper.

I claim as original the method of fastening long plates of sheathing by means of rods, as above described.

R. PORTER.

Billerica, Aug. 12, 1834.

REMEDY FOR DRY ROT.—The London Literary Gazette, of June 14, contains a sketch of a lecture upon Dry Rot, delivered by Mr. Faraday at the Royal Institution, from which we learn that a complete remedy has been discovered by a Mr. Kyan, who submitted his proposition to the Lords of the Admiralty, who have caused it to be proved and have advised him to take out a patent for it. The process is as follows: The timber is immersed in a solution of the corrosive sublimate, which is pumped into a tank, in which the timber is held down by a trans-

verse beam, so as to prevent its floating, and after submersion for a week the operation is completed.

It has already been adopted with the timber used in the National Gallery, the new works at the British Museum, the warehouses of the East India Company, by various churches and other public buildings; and many engineers connected with the Liverpool, Manchester, Stanhope, Tyne, and Wear railways, are using timber thus prepared, in lieu of stone sleepers. It is also extensively introduced in the ship yards of England, and many gentlemen have adopted it in their domestic architecture.—[Nat. Gaz.]

THIRST FOR KNOWLEDGE.—The Rev. Mr. Beaumont made the following statement in an address to the meeting at the last anniversary of the London Sunday School Union.

A number of children possessed the spirit of knowledge to which he had alluded, but they had no building in which to assemble, and no one to instruct them, but they nevertheless learned to read and write. What was the place in which they assembled? A grave-yard! What were their copies? The short and simple annals of the poor. What were their materials for learning to write? The mould scattered around the graves. By those simple means they learned to read and write. The meeting was perfectly aware how very prevalent knowledge was in Scotland, but he once heard one of the principals of the University give an interesting account of an occurrence which took place in his own parish. In one of the glens there was but one parochial school, and that was situated at its extremity, in consequence of which the children living at the other extremity could not attend. The inhabitants were too poor to pay for a schoolmaster, but they adopted the expedient of selecting the finest boy in the glen; a collection was made, he was sent to the Lowlands that he might there be instructed, and afterwards return to the glen and teach all the rest of the lads. He taught the children by day, and the adults in the evening; and so the stream of knowledge was set flowing all over the glen. He had heard their reverend brother from Jamaica state, that children in the West Indies had been made the honored instruments of teaching their parents. That was not the order of nature, but an order that the God of nature and of grace frequently sanctioned and blessed, and which had been going on, not only in Jamaica, but in the East Indies, and in various parts of Britain. They were told that the dew which refreshed the earth, and

fructified it, descended; but there were some who insisted that it rose out of the earth, and the question was not yet settled. He did not care which way knowledge came, provided it did come. Let it come every way, and the faster the better.

NEW COMET.—Professor Schumacher, Astronomer Royal of Denmark, announces in his "*Astronomische Nachrichten*," of the 7th inst. the discovery of a new comet on the 8th ult., by Professor Gambart, of the Marseilles Observatory. Although it disappeared on the 13th, and from the state of the weather, and temporary imperfection of his micrometer, his observations were interrupted and imperfect, Prof. Gambart assigns its place on the 10th at 16 h. 32 m. 45 s. of sidereal time, to 20 h. 9 m. 7 s. of right ascension, and $22^{\circ} 33'$ of south declination. When first seen, it was near the horizon, having a nebulous appearance, and situated in the constellation Sagittarius, very near the nebula 2064 of Sir John Herschel. The comet was of a pale light color, of a very round form, and with a diameter of about four or five minutes.—[*The Athenæum*, London, May 17, 1834.]

DISCOVERY OF A MUSCLE IN THE EYE OF FISHES.—Sir: I beg leave to announce to you the discovery of a muscle in the eyes of fishes, solving the problem of the accommodation of their eyes to distances in a more satisfactory way than by a greater or less degree of convexity of the cornea. The muscle is triangular, apparently attached to a nerve at one extremity. Another extremity is attached to the capsule of the lens at its axis. The third passes through a loop in the iris, and is attached to the vitreous humor. The lens is drawn backwards, when the portion attached to it contracts. When the portion that passes through the loop is called into action, the vitreous humor is pulled forwards, pushing the lens before it. This structure exists in the streaked bass, the sheep-head, the blue fish, the sea bass, and the poigee,—the only fishes in which I have had an opportunity of looking for it. If it be not too late, please to announce this discovery, which I believe to be new.—[*Am. Jour. of Science and Arts*.]

IMPORTANCE OF PERSEVERANCE.—"The great art to learn much," says Locke, "is to undertake a little at a time." Dr. Johnson has very forcibly observed that "all the performances of human art, at which we look with praise or wonder, are instances of the resistless force of perseverance; it is by this that the quarry becomes a pyramid, and that distant

countries are united by canals. If a man were to compare the effect of a single stroke of the pick-axe, or of one impression of a spade, with the general design and last result, he would be overwhelmed with a sense of their disproportion; yet those petty operations, incessantly continued, in time surmount the greatest difficulties, and mountains are levelled and oceans bounded by the slender force of human beings. It is therefore of the utmost importance that those who have any intention of deviating from the beaten roads of life, and acquiring a reputation superior to names hourly swept away by time among the refuse of fame, should add to their reason and their spirit the power of persisting in their purposes; acquire the art of sapping what they cannot batter, and the habit of vanquishing obstinate resistance by obstinate attacks."

Report of the Managers of the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, in relation to Weights and Measures. Presented in compliance with a Resolution of the House of Representatives. [From the Journal of the Franklin Institute.]

To the Hon. JAMES FINDLAY, Secretary of the Commonwealth of Pennsylvania.

The Managers of the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, respectfully present to the Secretary of the Commonwealth their report in relation to the subject referred to them by the direction of the House of Representatives. At the stated meeting of the Managers next subsequent to the receipt of the communication of the Secretary of the Commonwealth, dated May 29th, 1833, a committee was appointed to consider the subject, and to report to the Managers of the Institute. Their report, which has been unanimously adopted, is now respectfully submitted. It is believed that no more time has been consumed by the committee than was required by a careful investigation of the subject intrusted to them, and the Managers hope that the delay of this report beyond the time of meeting of the Legislature will be attributed to the necessity of the case.

ALEXANDER FERGUSON, Chairman.

WM. HAMILTON, Actuary.

Report in relation to Weights and Measures in the Commonwealth of Pennsylvania. Adopted by the Managers of the Franklin Institute, January 25, 1834.

The Committee of the Franklin Institute, appointed by the Board of Managers to consider the subject of weights and measures, referred to them by direction of the House of Representatives of the Commonwealth, respectfully report:

That since the date of their appointment, in June last, they have given to the subject

the attention which its importance so well deserved. In order to have before them, in a condensed form, the facts relating to the practical bearing as well as to the theory of the matters of inquiry, the Committee requested from three of its members reports upon the systems of weights and measures, of England, and of France, and upon the state of the question in our own country. The reports contained in the appendix, herewith presented, resulted from this request. In the first of these is given a description of the French metrical system, and of the scientific operations required in its establishment; in the second, a brief history of the weights and measures of England, with the method of connecting the recent and reformed system with a scientific basis; and in the third, an abstract of the reports upon weights and measures made to the Congress of the United States, and to the State Legislatures of Pennsylvania and New-York. An examination of these reports will show from how many points our subject has been viewed, and in what varied lights, and how little novelty can be expected in any view which at this time may be submitted. This circumstance will perhaps be found of important practical benefit, for a desire to present what is novel may have led to much of the inapplicable speculative inquiry with which the subject is encumbered.

The Committee think that they may assume that the House of Representatives of the Commonwealth, in referring the bill relating "to weights and measures and to admeasurement" to the Managers of the Franklin Institute, did not intend to confine their report exclusively to the consideration of that bill, but rather that it should form the basis of their investigations.

With this view of their duties, the Committee would propose to consider the subject under two suppositions: the first, that the Legislature of Pennsylvania shall determine, or have determined, to legislate in relation to a system of weights and measures for this Commonwealth, independently of other states; secondly, that a combined action by the several states, or by the Congress of the United States, may be admissible.

In legislating upon any matter which in its varied ramifications affects almost every business in which men engage, there cannot be too much caution. Usages have grown up in all trades, which have become a part of those trades which require a portion of an apprenticeship to learn, in contravening or changing which, by law, the interests of the citizen, if not his rights, are infringed. Hence the necessity of entering thoroughly

into details which can only be supplied by the members of each art, or trade, from their own knowledge of their own wants, and which should properly vary with the progress of that art; or of leaving such details to adjust themselves, upon the basis of careful legislation upon general principles.

A system of weights and measures, which aims at furnishing such general principles, should establish the standard of linear measure, and fix the relation of the standard of capacity measures to that of the linear measure; should provide for procuring, preserving, and distributing positive standards of measure and of weights, and should refer the entire system to natural invariable standards, by which its permanence might be secured. It should be accompanied by a supplementary law less fixed in its character, which should state the principal denominations of the several measures and of the weights, and their relation to each other and to the standards.

The system may contemplate an entire change in the standards and in the denominations; or it may aim at providing standards in conformity with those in most common use, and by which the accuracy of existing standards may be at all times tested, and at improving existing denominations.

The case of an entire change is presented by the French metrical system, where throwing aside, in their measures, the denominations of foot and toise, they adopted a new denomination, the metre corresponding to a new length, the ten millionth part of a quadrant of a terrestrial meridian. The present English system is in part of the second kind; leaving to usage to establish the denominations, it aims at providing positive standards of authority, and of perpetuating them by their comparison with invariable standards furnished by nature. The inability of the first system to contend against usage, is to be found in the establishment by law in France of a metrical foot, one-third of a metre in length, of a metrical pound half the kilogramme of the new system in weight. Had one currency been in use throughout our infant country when the present currency was established, it is not impossible that its beautiful simplicity might, even at this day, have existed only in theory.

Sound policy, nevertheless, requires that, from time to time, such changes should be introduced in existing denominations as will tend to simplify the system, and to bring it gradually nearer to perfection; but even in these, perhaps, the law should follow indications of change dictated by convenience, rather than undertake to lead them.

A system of weights and measures and of denominations based upon that in common use in our country, would include the following particulars: first, a reference to some existing measure as the standard of length; as, for example, to a certain yard measure in the possession of the State, which should be declared at a certain temperature to be the linear unit. The multiple and submultiple denominations of this standard should be declared as lines or nails, inches, feet, perches, &c. Second, a unit measure of capacity, as, for instance, the bushel, should be defined in reference to the linear standard. This unit might be taken for both dry and liquid measures, or it might be deemed advisable to conform to usage by providing different units for liquid and for dry measure. In regard to the denominations an obvious improvement might be made by avoiding the use of the same name for things essentially different, as a gallon for different capacities according to its use in dry or in liquid measure, a change which would not fail to be sanctioned by general adoption. Third, a reference to a positive standard for weight, as a certain pound in the possession of the State. The multiple and submultiple denominations to be regulated. And here a question presents itself, whether it may be possible to have but one unit of weight denominated the pound, rejecting the troy or avoirdupois pound, as may be thought advisable. In choosing between them, the difficulty presents itself that the former pound has been legalised by Congress in our coinage, by referring to the standard troy pound in possession of the mint, while the latter is the pound generally used in commerce. It is probable that this innovation could not be made with advantage at present. In regard to the denominations a similar difficulty is presented in the ton, which is either 2,240 or 2,000 lbs. according to locality, or to usage, or to agreement. To the adoption of the ton of 2,000 lbs. technically called the short ton, there does not seem to be any insuperable objections. It is so convenient in practice that it has been legalized by several of the States, and is used in many cases in our own Commonwealth.

In providing for the distribution of positive standards throughout the State, the nature of the material of which they shall be made will be an important item. For the material of their positive standards of length, the French adopted iron, the English brass; for those of weight, the former employed platinum for the original standard, and brass for the copies; the latter brass for both. In case of the adoption of either metal, it would

be important to inquire by experiment more carefully than has been hitherto done, into their relative expansions under different circumstances of manufacture. This would not bear merely upon the theoretical perfection of the standards, but upon that in practice, for two standards which were alike when made in winter, might, if compared in summer, differ so much that one would be thought to require the expense of alteration. If the yard stick of the merchant will not be changed by this difference, it will become sensible in the chain of the surveyor, and the landholder will find his limits affected by it.

Next, the positive standards thus provided should be referred to some natural invariable standard. The necessity for this reference is so frequently denied that the object would seem not always to be perceived. Positive standards are liable to change by accident and by use. Let us suppose a case in which a standard of measure belonging to the Commonwealth, and carefully deposited in one of its offices, receives injury in taking it down for examination or in course of a comparison of another measure with it. The county standards are resorted to, for the purpose of recovering the original length of the standard, but if not well preserved, or if frequently used, they disagree. It is in such a case, and the probabilities are strong of the occurrence at some time of similar cases, that the natural invariable standard becomes the means of deciding between the varying measures. The length of a pendulum vibrating seconds or the arc of a meridian is measured by using either of the measures; the length thus found is the same number of inches and parts of an inch with that of the pendulum or of the arc, which was previously fixed with reference to the original standard, or is so many parts of an inch too long, or too short, and the length of the original measure is known by reference to that which has been tested. But it is not necessary to resort to any supposition of accident which may occur to the positive standard; the experience of England has shown that, under ordinary care, changes will be found from century to century, and that measures which are at one time easily known and recognized to be the standards, may at some other time be the subjects of antiquarian research. Part of the reproach under which the scientific operations here referred to lie, namely, that they are liable to corrections as science progresses, is due to the fact that experimenters have not been satisfied with stating the results of experiment, but have endeavored to deduce from

theory the relation between those results and others in other circumstances, using for this purpose the data furnished by the science of the day. Thus they have not been satisfied with stating that the pendulum vibrating seconds, and in a circular arc, measured with a means described, at a given temperature and pressure, and at a particular spot, was a certain number of inches of the standard; but they have undertaken from their experiment to conclude what the length would be in a vacuum, in a small arc, at an assumed temperature and pressure, at the level of the sea, and in a particular latitude, and these before the weight of the air, the effect of its buoyancy, &c. were well known and established, even according to the knowledge of the day.

The Committee, in the discharge of the duty committed to them by the Managers, proceed to submit their examination of the bill referred by the House of Representatives; in this they will be as brief as is permitted by the fact that many of the provisions of it are at this time the law of the State. If the Committee are correct in the ideas which they have already expressed in relation to the requisite enactments for regulating weights and measures, the objection to the bill, on the score of its leaving general principles to enter partially into details, is a sound one; this remark has reference more particularly to that part of the bill which relates to admeasurement, in relation to which it will be necessary for the Committee to go into minutiae, in order to be intelligible.

The twenty-seventh and twenty-eighth sections establish a certain ratio between the weight of different commodities, and the measured bushel, in regard to which, as far as the usage of this portion of our State can be ascertained, four of the commodities mentioned are not bought and sold by weight; and of the two which are, one is always purchased at a different weight per bushel from that assigned in the sections, the brewers of Philadelphia always buying their barley at the rate of forty-eight pounds to the bushel. Salt of all descriptions pays duty at the rate of fifty-six pounds to the bushel, and is in all cases sold by measure. The usage will probably be found to be different in other parts of the State, for where materials are concerned which have weights in proportion to their bulk, varying with soils and seasons, or, as in the last case, with the moisture of the air, equitable dealing could not fail to produce such differences.

In regard to the scale of anthracite coal, provided for by section twenty-nine, no men-

tion being made of the bituminous coal, usage has established its scale by weight, and no necessity exists for providing a ratio between measure and weight.

The measure of an acre of land, of a cord of wood, or bark, the contents of a hogshead of cider, each is made the special subject of a section, while other superficial measures, the measurement of lumber, &c., the contents of casks of beer, ale, whiskey, &c. &c., are left, as indeed all should be left, to the regulation of inspection laws, or to usage.

Section tenth is liable to similar objections, as providing for a peculiar form to be given to the bushel for measuring lime, which is one only of the many commodities sold by the heaped bushel. A provision for a legal standard bushel would regulate all such cases. The law provides in section seventh for both a wine and a beer gallon, a provision which the committee consider particularly objectionable, the inconvenience of two different measures having the same name, is obvious, and practice confirms the conclusion: the beer gallon being no longer, as far as the committee can ascertain, in use, at least in the city of Philadelphia.

The Committee would further remark, that they have not been able to find why the regulator of the weights and measures of the city of Philadelphia should not be subjected to the same enactments with other regulators or inspectors: the want of inspection laws to regulate the duties and fees of the office seems to be felt by the citizen who now fills, with industry and zeal, the office of regulator of this city.

Leaving these details, the Committee would urge a general objection to the portion of the bill referring to the positive standard for weights and measures. It is that, after providing for procuring those standards and distributing them, by means which would require an expenditure not at all, however, beyond the necessity of the case, it renders nugatory the whole of the work done, by providing that whenever the United States' standards shall be declared, those of the State shall conform thereto. The existence of a system which has cost the State much time and labor is thereby made contingent upon their obtaining standards which *may* be those adopted by Congress at some future day, or upon the want of action of the United States upon the matter. The difficulty of a change after a complete distribution of standards would necessarily be much greater than at a time when the want of some standard was generally admitted.

With great deference to the body who are

to consider the subject, the Committee have prepared an altered draught of a bill in conformity with the views which they have submitted in the foregoing, and which they respectfully submit for examination, under the supposition that legislation is, at this time, deemed advisable. The bill containing the general provisions for a system of weights and measures is accompanied by a supplementary one establishing the legal denominations. In regard to the manner of this appointment of regulators or sealers of weights and measures, to the securities to be required for the faithful performance of their duties, to the penalties for negligence, and to the penalties for infringement of the provisions of the bill, the Committee do not consider it within their province to offer any remarks, further than that they are of opinion that they may conveniently form a separate subject of legislation, and should not be incorporated with the general enactments.

The Committee will next proceed to a more grateful portion of their duty than that which required the criticism of the bill referred to them; namely, to consider the case in which action by the Congress of the United States may be deemed by the Legislature to be advisable. Next to the inconveniences which result from a varying standard of measure and weight in the same community or neighborhood, may be ranked those produced by a want of uniformity in the standards of different contiguous States; for it must happen, in a republic organized as is our own, that the different parts of the same State have less frequent communication requiring the use of such standards, than the adjacent parts of the different Commonwealths. So impressed are the Committee with this view, that they would express it as their decided opinion that the most imperfect system of weights and measures which has ever been framed, would, if applied in all the States of our Union, be preferable to the most perfect system which should be adopted by any one Commonwealth singly. The Constitution having delegated to Congress the power "to fix the standard of weights and measures," there seems to be no doubt but that that body have authority to legislate upon such a system as has been offered for the consideration of the House of Representatives of this Commonwealth, in which the object is rather to fix standards so that they shall not be liable to change for the future, than to make innovations in existing legal standards. Indeed, in most of the laws of more recent origin adopted by several States, there is a distinct provision, that when Congress shall furnish a system of weights and

measures for the United States, the temporary State standards shall be made to conform to the national standard. The exceeding importance of uniformity is thus distinctly set forth, from quarters of the highest authority in the different parts of our extended republic.

In the multitude of objects to which the national legislation must be directed, it is hardly to be wondered at, that no action should have taken place upon this one. If the wants of the States, or any of them, should be expressed, Congress could hardly fail to take up a subject upon which so much unanimity of view might be expected. Frequent consideration has been given by that body to providing a system of weights and measures, even without the stimulus just referred to, as appears by a reference to the analysis of their proceedings accompanying this report. So far as the collection of the revenue is concerned, the object of uniformity in the standards is near its accomplishment, under directions, issued from the Treasury Department of the United States, for the distribution of standards to the custom-houses; and thus one motive which might have induced the action of Congress is removed, and the necessity for exertion on the part of the States, to secure so desirable an object, is increased. That standards issued to the custom-houses can be substituted for national standards, even though legalized in the collection of the revenue, by an act of Congress, is obviously impossible: unrecognized by the laws of the States which contain no provisions deferring to such standards; not placed at all in some of the States, and but sparingly distributed in any, they could not, even by usage, and in violation of the State laws, become standards. They would tend merely to increase the diversity of standards, and unless conforming to those of the State in which they were introduced, would cause duties to be paid on commodities by one measure or weight which were sold by a different standard. The Committee would therefore most respectfully request the Managers of the Franklin Institute, to urge upon the House of Representatives, of this Commonwealth, to call the attention of Congress, through our Senators and Representatives, to the necessity of fixing the standard of weights and measures throughout the United States; and further to suggest that the co-operation of the Legislatures of other States be obtained by executive communication.

Your Committee feel satisfied that the House of Representatives of this Commonwealth may lay the subject now under consideration before Congress in a form so con-

veniently adapted to their legislation upon it, that a speedy action will be ensured. But should this action be delayed for two or three years, the inconvenience of action under existing laws, for such a period, would hardly counterbalance the probability of benefit to be derived from legislation by Congress. If such just hopes should be disappointed, the people of this Commonwealth would then confidently look to the care of their legislature to furnish them with standards so essential to the dealings of all classes of the community.

COMMITTEE.

Alex. Dallas Bache,
S. V. Merrick,
William. H. Keating,
Rufus Tyler,
M. W. Baldwin,
Benjamin Say,
Asa Spencer,
Abraham Miller,
R. M. Patterson, M. D.
Sears C. Walker,
Benjamin Stancliff,
Thos. McEuen, M. D.
Edmund Draper,
David H. Mason,
Benjamin Reeves,
Thos. P. Jones, M. D.
Frederick Fraley,
Samuel Moore, M. D.
Samuel Hains.

An Act to fix the Standards of Measures and Weights in the Commonwealth of Pennsylvania.

TABLE OF CONTENTS.

- Section 1—Fixes the standard of linear measures.
 “ 2—Fixes the standard of capacity measures.
 “ 3—Fixes the standard of weight.
 “ 4—Determines the positive standard of length, to be provided by the Governor.
 “ 5—The Governor to provide the positive standards of measures of capacity.
 “ 6—The Governor to provide the positive standards of weight.
 “ 7—Provides for the preservation of the positive standards.
 “ 8—Provides for the verification of the positive standards.
 “ 9—Provides for the distribution of the county standards.
 “ 10—Provides for the verification of the county standards.
 “ 11—Positive standards to be referred to natural invariable standards.

An Act to fix the Standards of Measures and Weights.

Section 1.—Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is hereby enacted by the authority of the same: That the standard unit of all measures of length shall be the “yard,” to conform to that in use in this Commonwealth, at the date of the Declaration of Independence, the positive standard to be obtained as hereinafter described; and that one-third of said yard shall be one foot, and one-twelfth of said foot shall be one inch.

Section 2.—And be it further enacted by the authority aforesaid, That the standard of liquid measure shall be the gallon, to contain two hundred and thirty-one cubic inches of the standard aforesaid, and no more. And that the standard of dry measure shall be the bushel, to contain two thousand one hundred and fifty cubic inches and forty-two hundredths of a cubic inch of the standard aforesaid, and no more.

Section 3.—And be it further enacted by the authority aforesaid, That the standard of weight shall be a pound, to be computed upon the troy pound of the mint of the United States, referred to in the act of Congress, of 19th May, 1828, to wit—the troy pound of this Commonwealth shall be equal to the troy pound of the mint aforesaid; and the avoirdupois pound of this Commonwealth shall be greater than the troy pound aforesaid, in the proportion of seven thousand to five thousand seven hundred and sixty.

Section 4.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor of this Commonwealth to procure, within — years from the date of the passage of this act, a standard yard, to constitute the positive standard of length in this Commonwealth; said standard to be equal in length, at the temperature of melting ice, to the distance between the eleventh and forty-seventh inches on a certain brass scale of eighty-two inches in length, procured for the survey of the coast of the United States, and now deposited in the war department. The material of said standard to be brass, and the divisions upon it to be inches and parts of an inch of the brass scale aforesaid.

Section 5.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor to procure, within — years after the passage of this act, for the use of this Commonwealth, a standard gallon and bushel, to conform to the provision of section second, of this act. The material of said standard to be cast brass.

Section 6.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor of this Commonwealth to procure, within — years after the passage of this act, a duly authenticated copy of the troy pound of the mint of the United States, to constitute the positive standard of weight of this Commonwealth. The material of said standard to be brass.

Section 7.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor of this Commonwealth to have the positive standards of measures of length and capacity, and of weight, provided by the foregoing sections, inclosed in suitable cases and deposited in the office of the Treasurer of this Commonwealth, to be by him there carefully preserved.

Section 8.—And be it further enacted by the authority aforesaid, That it shall be lawful for the Governor of this Commonwealth, when he shall deem it expedient, to have tested the conformity of said positive standards of measure and weight to the foregoing provisions of this act, or to the natural invariable standards hereinafter provided.

Section 9.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor to provide, within — years after the passage of this act, for each of the counties of this Commonwealth, at the charge of the counties respectively, duly authenticated copies of the positive standards of measures of length, of capacity, and of weight, referred to in the foregoing sections, of the material therein referred to, and of approved construction. And having caused the same to be duly stamped, to have them delivered to the Commissioners of the counties respectively, to be used as standards for the adjusting of weights and measures, and for no other purpose.

Section 10.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Commissioners of the respective counties, at least once in every ten years, and oftener if they have reason to believe it necessary, to cause the standards of the respective county to be examined and tried, and, if necessary, to be corrected or renewed according to the standards of the Commonwealth heretofore referred to.

Section 11.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor, within — years after the passage of this act, to cause the positive standards, herein described, to be referred to natural invariable standards, and to deposite in the office of the State Treasurer the authentic certificates of such reference, with the apparatus by which it was made. The

length of the standard yard to be compared with that of the pendulum vibrating seconds at a certain and defined spot in the Independence Square in the city of Philadelphia or in some unalienable public property, at an ascertained and convenient temperature and pressure; all the circumstances of the comparison to be stated. The standard of weight to be compared with that of one hundred standard cubic inches of water, at its maximum density, and at a convenient atmospheric pressure.

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An Act to fix the Denominations of Measures and Weights in the Commonwealth of Pennsylvania.

TABLE OF CONTENTS.

- Section 1—Fixes the denominations of linear measure.
 “ 2—Fixes the denominations of superficial measure.
 “ 3—Fixes the denominations of liquid measure.
 “ 4—Fixes the denominations of dry measure.
 “ 5—Fixes the denominations of weight, which refer to the troy standard.
 “ 6—Fixes the denominations of weight, which refer to the avoirdupois standard.

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An Act to fix the Denominations of Measures and Weights.

Section 1.—Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is hereby enacted by the authority of the same: That the denominations of linear measure of this Commonwealth, whereof the yard, as heretofore provided, is the standard unit, with the relations thereof, shall be as follows:

- 12 inches make 1 foot.
 3 feet make 1 yard.
 5½ yards make 1 rod, pole, or perch.
 40 rods make 1 furlong.
 8 furlongs make 1 mile.

Section 2.—Be it further enacted by the authority aforesaid, That the denominations of superficial measure of this Commonwealth, whereof the square of the linear yard, as heretofore provided, is the standard unit, with the relations to said standard, and to each other, shall be—

- 30½ square yards make 1 pole or perch.
 40 square poles make 1 rood.
 4 square roods make 1 acre.
 640 acres make 1 square mile.

Section 3.—Be it further enacted by the authority aforesaid, That the denominations

of liquid measure of this Commonwealth, whereof the gallon, as heretofore provided, is the standard unit, with the relations to said unit and to each other, shall be—

4 gills	make 1 pint.
2 pints	make 1 quart.
4 quarts	make 1 gallon.
31½ gallons	make 1 barrel.
2 barrels	make 1 hogshead.
2 hogsheads	make 1 pipe.
2 pipes	make 1 ton.

Section 4.—Be it further enacted by the authority aforesaid, That the denominations of dry measure of this Commonwealth, whereof the bushel, as heretofore provided, is the standard unit, with the relations to said standard and to each other, shall be—

4 pecks to make 1 bushel.

And the minor divisions of the peck shall be its aliquot parts. Provided, that the form of the dry measures shall be conical, that the diameter of the circle of the top of the measure shall be not less than one twentieth greater than the diameter of the bottom of the measure, and the height not more than nine twelfths of the diameter of the bottom.

Section 5.—Be it further enacted by the authority aforesaid, That the denominations of weight of this Commonwealth, whereof the troy pound, as heretofore provided, is the standard unit, with the relations thereof to said standard and to each other, shall be—

24 grains	make 1 penny-weight.
20 penny-weights	make 1 ounce.
12 ounces	make 1 pound.

Section 6.—Be it further enacted by the authority aforesaid, That the denominations of weight of this Commonwealth, whereof the pound avoirdupois, as heretofore provided, is the standard unit, with the relations to said pound and to each other, shall be—

16 drams	make 1 ounce.
16 ounces	make 1 pound.
25 pounds	make 1 quarter.
4 quarters	make 1 hundred.
20 hundreds	make 1 ton.

We have received the Mechanics' Banner and the Working Men's Shield, a new paper established in the city of Baltimore, by Mr. Robert Ricketts, devoted to the interests and improvement of the working class. From the number which we have received, we should judge it to be a paper well edited, and to say the least, it bids fair to be an able advocate of the cause it espouses. The editor, among other subjects, gives the following true picture of the *Vicissitudes of Life*.

The clergyman, as he weeps over his stubborn flock, and sees them in spite of his prayers and entreaties pursuing "the error of their way," exclaims, "surely none have difficulties like the minister;" and the physician, as he rouses from his midnight sleep to encounter the chilling winds of winter, and comes shivering to the bedside of his patient, rubs his thumb over his lancet, and says, "would that I had never been a doctor." The farmer, as he tills his land, from the rising of the sun until the going down of the same, "sowing his seed in the morning, and on the evening withholding not his hand," stands kimbo upon some sun-parched field, and as he views the scorched grain and withered grass, bending their tops to the burning soil, with a smileless lip he says, "woe is me, for my troubles are past endurance;" and the slave, as he lifts his hand from the spade that is worn smooth by his grasp, raises his fettered arm towards the heavens, and execrates the light that hails him to his toil. The politician pours for years over some splendid scheme, and fancies the day not far distant when he shall fill to the brim the measure of his own with his country's glory; he starts as the tide of public opinion comes rolling against him, resistless as the Simoon of the sandy desert, and the dying away of the winds bears his moan upon their bosom—"vain and vexatious are the pursuits of the statesman." The lawyer ransacks the musty doings of past ages—studies hard and long to effect the overthrow of his opponent, piles up and pulls down, and turns over and over again the pages of innumerable volumes, speeds his way, loaded with books to the court room, contemplates his success, and already fancies his name to be recorded upon the highest Collocate upon the column of fame. He lifts his voice amid the learned assembly, and the plaudits of the admiring multitude cheer him onward. He submits his case to the jury, and retires from the court flushed with satisfaction, and blushing beneath the high honors of his auditory; he seeks his client, and tells him to rejoice, and like a hero returning from his victory with the laurel of triumph upon his fevered brow, he enjoys a momentary glow of exalted pleasure; but, alas for him, the return of the jury reverse the verdict his own imagination has conceived, and he hates the hour he was born. The merchant tarries till the breaking of the day at his gas light desk, and counts and calculates with a sleepless age, and an anxious heart; thousands are his due, but they are held by his fellow-men; he fondly believes it all secure, and exults in the expectation of happiness; one failure,

and another, and another, take place; he denounces the whole human race, and in the moment of his distress reflects upon all the world of men as scoundrels but himself.

The warrior, as he rushes to the crimson plain, covers his course with the bodies of the dead, and as he sinks with the steel in his heart, his last cry is "the soldier's career is attended with doubt, danger, and difficulty, and his reward is death." The sailor springs from his hammock slumbers, and as he mounts the yards, in the solitary watch of the night, mingles with his "yo heave" a curse upon the difficulties of life. The mechanic toils from sun to sun, and as he returns from the monotony of his daily avocation, he ponders over his oppressed situation,—his home, his wife, his children, all gather about his heart; the feelings of his nature rive him to the quick, and he fain would lift his arm and cry, *these things shall not be*, but finds it fettered, and his free-born soul is goaded by the scorpion sting of imposition, as he bends his neck again to his slavish toil. But the printer, the poor printer—who shall begin to sum up the amount of his difficulties? Human language and human effort are inadequate, and human calculation, with all its catalogue of human woes, reach not the deep recess where spring the printer's difficulties. The tears of the clergyman, the shivering of the physician, the fears of the farmer, the distresses of the slave, the failures of the politician, the mortifications of the merchant, the despair of the conquered soldier, the woes of the sailor, and the mechanic's bitter reflections—all, all, and a myriad more, harrow the printer's heart. The calender of human evil, like the solar sun, sends its converging rays, and all concentrate upon the printer's head. The printer must hear every thing, feel every thing, see every thing, know every thing, and tell it in the right time, or he knows nothing about his business; he must be a very Proteus in every sense of the word; his calvarium must be marked by every bump in Gall and Spurzheim, and then he will do well to prepare himself for abuse and fault-finding. We have said all of the above, courteous reader, by way of apology for the long delay of the second number of our paper; and if we have not said enough, may the shades of Charon help us, for we had better gather up our spoils and prepare for a journey across the Stygian Lake. We are inclined to think that we will never commit the sin of getting up another paper. We saw difficulties in the commencement, and prepared to surmount them; but the strained imaginations of the most untrammelled poet

never conceived, in his boldest flight, the Alpha of our troubles: what the Omega shall be, time must write.

On the Probable Location of Railroads and Canals. To the Editor of the American Railroad Journal, &c.

SIR,—A writer, who signs himself "C. O."* (Deep Creek,) has suggested a few remarks on the location of railroads and canals, in which he proposes to call attention to the proper direction of these works, so as to meet the general improvements now progressing in our extensive country, and to adapt them to such advances as future enterprise may produce. He has, however, only touched the outline of the subject, without investigating the principles upon which such works should be conducted: considerations which are indispensable for the accomplishment of the object proposed. In the following views, the inquiries of "C. O." are pursued and extended, and, it is hoped, illustrated in such a way as to call the attention of the public to an examination of this interesting subject.

It may be very difficult, in treating a subject of this kind, to avoid the consideration of the question which of the two modes of conveyance, railroads or canals, is to be preferred, and likely to supersede the other in public estimation.

As the subject has been investigated by the ablest engineers, and others qualified to judge, both in Europe and the United States, the whole of which is to be found in the preceding pages of the Journal, it will be avoided, so far as may be done without leaving the matter under discussion imperfectly explained.

The subject of canalling in our country has been the theme of such profound inquiry—the several practicable and even possible routes and plans for such works so often made the subject of minute estimate and investigation—that it may be said to be in a manner exhausted. It is at this time scarcely possible to find a line of country of any extent, through which such work could be opened without incurring an expenditure not be justified by the profits. The success of the Hudson and Erie Canal in New-York has induced numberless efforts of this kind, and awakened an almost enthusiastic zeal in favor of them. The public were captivated by the brilliant results from this gigantic enterprise, not only in the amount of tolls, but also in the universal improvement in the value of the landed property which followed its completion. But in how few other cases has success attended the opening of canals? Even in the state of New-York, many of the canals which have been made since the completion of the first great work have been failures, and are now supported from the profits of the one first completed.

The great canal now under construction from Washington city to the Ohio, (the Chesapeake and Ohio Canal,) if ever completed, is not expected to afford tolls to the amount of 2 per cent. on its cost; and yet this passes

* See *Mechanics' Magazine*, vol. iii., p. 366.

through a country abounding in agricultural production, and mines of valuable minerals.

The Delaware and Chesapeake canal is understood to be an unproductive stock; and the canal, through the Dismal Swamp, which has been more than 30 years in progress, now that it is completed, is found to produce a very meagre dividend in tolls. Of the canals cut by the state of Pennsylvania, and the chartered companies within its limits, scarcely one in ten is expected to be profitable stock, and its citizens are now turning their attention to railways, &c., as a substitute for them. In short, there is scarcely a great work of this kind, (the Hudson and Erie Canal excepted,) which has not terminated unfavorably to the adventurers. It is not proposed to enter into an inquiry what, in our country, has been the cause of these failures in canals—works which are so productive in the European states; but merely to assume the fact, as one which will not be controverted by persons experienced in these works, that, in our country, canals are enterprises attended with danger of loss to the parties adventuring, and that there are few situations when they could be attempted, (on a large scale at least,) without hazard of the loss of capital.

With respect to railroads, the matter may be said to be very different. They may, it is believed, be constructed under many circumstances in which canals are inapplicable, at less cost, and an almost absolute certainty of giving a better return in tolls for the capital employed.

The following are the principles which, it is believed, should direct the selection of a route for a railroad, and which, if practised on, will insure success, without regard to future changes or contingencies.

In the first place, railroads should be laid out to run from the fertile districts of the interior of the states, to some (the nearest) seaport or navigable waters, whence the articles conveyed on them may be transported to a foreign or distant market.

2dly. The great intercourse now subsisting between the seaport towns on the Atlantic require the benefits of this mode of conveyance. The time cannot be far off when this intercourse will be increased to an indefinite extent. In the interim, railroads may be built with a certainty of profit between any of these cities, until a continuous line is finished from Boston, (perhaps Portsmouth, N. H.) to St. Mary's, in Georgia; and it is probable the line might be safely extended from St. Mary's to St. Mark's, on the Gulf of Mexico, the intervening country between the two places having been ascertained by Gen. Bernard to be eminently favorable to such a work, (the peninsula being only 150 miles across, and the highest land on the ridge about 50 feet above the level of the ocean.)

Another class of railroads which promise certain profit on the capital invested, are the lateral roads which will be run from the mines

of coal, iron, lime, plaster, &c., which abound in the mountainous region of some of the states, to some road or canal extending from the fertile interior districts of the country to a seaport. The number of lateral roads which will be required for the transport of these products of the mines, must be matter of conjecture. Every day adds to the discovery of beds of valuable mineral substances, and to the number of mines opened: from all which lateral roads must be constructed to intersect the nearest railroad or canal to navigable water. Many of these are already in profitable operation, and are connected with some main line of railroad or canal, by which the produce of the mines is conveniently carried to market.

From what has been said, it would seem that canals offer few inducements for the enterprising to engage in their construction; that few situations in our country are adapted for this purpose, unless at an expense which the profits will not justify; that, if constructed at all, the selection of the routes must be left to the judgment of the engineer, looking to the probable advances of the country in other general improvements; that no definite rules can be laid down for their construction, their success depending upon so many contingencies, not likely to be united in their favor, &c. But that railroads may be undertaken with confidence of success, wherever they are made to run from a seaport or navigable water to a district of the interior country, which affords a large quantity of valuable agricultural or manufacturing products; that they will succeed, if run from one seaport to another, everywhere on the Atlantic coast, from Portsmouth, N. H., to St. Mary's, Ga., and probably across the peninsula to a port on the Gulf of Mexico, (as St. Mark's;) and, lastly, that they will probably yield a certain and profitable return, when run laterally from beds of mineral products, to intersect other main railroads or canals leading to a place of export.

The introduction of locomotive engines, to propel carriages on railroads, has greatly added to the utility of this mode of conveyance; and the improvements which modern enterprise has made in their structure, increasing, to an almost unlimited extent, the power of the engine, and at the same time giving greater strength, and affording a surer protection from casualties, will serve to exalt them in the public estimation and insure their universal employment.

CIVIS.

LEAD MINES.—No lead mines in the world are supposed to be richer or more abundant than those of Missouri, on the borders of the Mississippi. The ore is often found within two feet of the surface of the ground, in detached masses, weighing from one to eighteen hundred pounds. The annual produce is calculated to be three millions of pounds.